Patent Claims

1. A lifting apparatus for transporting a container, said device comprising a main frame and two shuttle booms, wherein respectively one shuttle boom is positioned such that it exits at one longitudinal-side end of the main frame and can be moved in longitudinal direction of the main frame and wherein the free ends of the shuttle booms are provided with holders for attaching the container, characterized in that the shuttle booms (3) and/or the holders are operated by means of an electric drive and that the shuttle booms (3) are guided with roller bearings inside a main frame (2).

2. A lifting apparatus according to claim 1, characterized in that the shuttle booms (3) are made of carbon fiber compound materials or of steel.

3. A lifting apparatus according to one of the claims 1 or 2, characterized in that the electric drive comprises two electric motors (10), wherein each electric motor (10) respectively drives a toothed belt (11), which engages in an energy-supply rod (5) on a shuttle boom (3).

4. A lifting apparatus according to claim 3, characterized in that the shuttle booms (3) have identical designs and are respectively provided with two crossbeams (4), arranged parallel and at a distance to each other, which are guided inside slide-in

compartments (12, 12') of the main frame (2) and between which the energy-supply rod (5) of the respective shuttle boom (3) extends.

5. A lifting apparatus according to claim 4, characterized in that the crossbeams (4) of the shuttle booms (3) are guided respectively displaced to the side inside the main frame (2), wherein a separate slide-in compartment (12, 12') is provided for each crossbeam (4).

6. A lifting apparatus according to one of the claims 1 – 5, characterized in that the roller bearings are provided with rollers (15, 16, 17, 18), the rotational axes of which extend crosswise to the longitudinal axis of the respective shuttle boom (3).

7. A lifting apparatus according to claim 6, characterized in that the rollers (15, 16, 17, 18) are made of polypropylene or rigid expanded polyurethane.

8. A lifting apparatus according to one of the claims 6 or 7, characterized in that the rollers (15, 16, 17, 18) are positioned with springs.

9. A lifting apparatus according to one of the claims 6 - 8, characterized in that the crossbeam (4) back, positioned inside the main frame (2), of each shuttle boom (3), is provided with two opposite-arranged rollers (15, 16) on the crossbeam (4), wherein the first roller (15) projects over the top surface of crossbeam (4) and the second roller (16) projects over the underside of crossbeam (4), so that these

rollers rest against the inside walls of the respective slide-in compartment (12, 12').

10. A lifting apparatus according to claim 9, characterized in that the first and second rollers (15, 16) respectively rest on a roller block (20), wherein the roller block (20) is positioned on a spring (22).

11. A lifting apparatus according to one of the claims 6 - 10, characterized in that a third roller (17), which is positioned on the underside of the respective slide-in compartment (12, 12'), is provided at each exit of each slide-in compartment (12, 12'), on which the crossbeam (4) of a shuttle boom (3) ends and that the underside of the respective crossbeam (4) is guided on this roller.

12. A lifting apparatus according to one of the claims 9 - 11, characterized in that the first, the second and the third rollers (15, 16, 17) respectively extend over the complete width of a crossbeam (4).

13. A lifting apparatus according to one of the claims 11 or 12, characterized in that the third rollers (17) are respectively positioned on a spring buffer (24).

14. A lifting apparatus according to claim 13, characterized in that the spring buffer (24) consists of "Vulkullan."

15. A lifting apparatus according to one of the claims 11 - 14, characterized in that each third roller (17) is assigned a buffer plate (19, 19'), which is arranged opposite the roller on the top of the respective slide-in compartment (12, 12') for guiding the respective crossbeam (4).

16. A lifting apparatus according to one of the claims 6 - 15, characterized in that additional rollers (18) for the side guidance of the respective crossbeam (4) project from the insides of the side walls of each slide-in compartments (12, 12').

17. A lifting apparatus according to one of the claims 1 - 16, characterized in that respectively one head piece (6) is glued onto the free longitudinal-side ends of the shuttle booms (3) for positioning the holders.

18. A lifting apparatus according to claim 17, characterized in that layers of Vulkollan (25, 27) are provided as adhesive layers between a shuttle boom (3) and the respective head piece (6).

19. A lifting apparatus according to claim 18, characterized in that at least one layer of Vulkollan (27), which forms a buffer, is positioned between the underside of the respective shuttle boom (3) and a shoulder (26) of the head piece (6).

20. A lifting apparatus according to one of the claims 17 - 19, characterized in that electrically operated locking pins (7) are provided at the free ends of a head piece (6) that project on the side over a shuttle boom (3).

21. A lifting apparatus according to claim 20, characterized in that the locking pins (7) are operated with electric motors (30).

22. A lifting apparatus according to one of the claims 17 - 21, characterized in that at the free ends of a head piece (6) that project on the side over a shuttle boom (3), electrically operated corner guides (9) are provided as holders for positioning on a container.

23. A lifting apparatus according to claim 22, characterized in that planetary gears (36) are provided for realizing the pivoting movements of corner guides (9).

24. A lifting apparatus according to claim 22, characterized in that rotation magnets are provided for realizing the pivoting movements of corner guides (9).

25. A lifting apparatus according to claim 1, characterized in that at least one linear drive (37) is provided for driving each shuttle boom (3).

26. A lifting apparatus according to claim 25, characterized in that each crossbeam (4) of the shuttle booms (3) is driven via a separate linear drive (37).

27. A lifting apparatus according to claim 26, characterized in that each linear drive (37) comprises a primary component (38) that is positioned stationary at the slide-in compartment (12, 12') associated with the crossbeam (4) and a secondary component (39) in the form of a metal rail, which extends in longitudinal direction of the respective crossbeam (4).

28. A lifting apparatus according to claim 27, characterized in that each secondary component (39) extends over the complete length of a shuttle boom (3).

29. A lifting apparatus according to one of the claims 27 or 28, characterized in that the surfaces of the primary component (38) and the secondary component (39), which are facing each other, are kept at a constant distance to each other by means of roller spacers (43).

30. A lifting apparatus according to claim 29, characterized in that the rollers spacers (43) form a part of the roller bearings.

31. A lifting apparatus according to one of the claims 25 - 30, characterized in that a securing device is provided for fixing a shuttle boom (3) in a predetermined displacement position.

32. A lifting apparatus according to claim 31, characterized in that the securing device is a brake (40) that acts upon the energy-supply rod (5) of the respective shuttle boom (3).

33. A lifting apparatus according to claim 32, characterized in that the brake (40) is a block brake.

34. A lifting apparatus according to claims 25 - 33, characterized in that each crossbeam (4) of a shuttle boom (3) has a rectangular cross section, the cross-sectional surface of which is adapted to the cross-sectional surface of the cavity of the associated slide-in compartment (12, 12') and that the primary component (38) of a linear drive (37) is inserted into a recess (42) in one side wall of one slide-in compartment (12, 12'), so that the primary component (38) is positioned opposite the secondary component (39) of the linear drive (37), which is arranged on one side wall of crossbeam (4).

35. A lifting apparatus according to claims 25 - 33, characterized in that each crossbeam (4) has an H-shaped cross section and consists of a support element (4a) and two guide elements (4b), wherein the side walls of the support element (4a), which extend in vertical planes, are at a distance to the parallel extending side walls of the associated slide-in compartment (12, 12'), and wherein respectively one guide element (4b) rests on the top and underside of the support

element (4a), so that these project over the side walls of the support element (4a) and fit tightly against the insides of the slide-in compartment (12, 12').

36. A lifting apparatus according to claim 35, characterized in that the support element (4a) and the guide elements (4b) of a crossbeam (4) respectively have a rectangular cross section.

37. A lifting apparatus according to one of the claims 35 or 36, characterized in that the widths of the guide elements (4b) are adapted to the widths of the slide-in compartment (12, 12').

38. A lifting apparatus according to one of the claims 35 – 37, characterized in that the primary component (38) of the electric motor (30) is arranged on the inside of the side wall for the slide-in compartment (12, 12') and that the secondary component (39) is arranged such that it extends along one side wall of support element (4a) in longitudinal direction.

39. A lifting apparatus according to claim 1, characterized in that the electric drives are drum motors (44) and that each shuttle boom (3) has an energy-supply rod (5) that is clamped between two drums (45) of two drum motors (44), wherein the energy-supply rod (5) can be displaced by turning the drums (45).

40. A lifting apparatus according to claim 39, characterized in that the energy-supply rod (5) has a top side and an underside, on which the drums (45) of a drum motor (44) can respectively roll off.

41. A lifting apparatus according to one of the claims 39 or 40, characterized in that a friction lining is installed on the outer surface of the drums (45) of drum motors (44).

42. A lifting apparatus according to claim 41, characterized in that the friction lining consists of a wear-resistant rubber material or a glass-fiber containing plastic casting compound.

43. A lifting apparatus according to one of the claims 40 – 42, characterized in that a friction lining is applied to the top side or underside of each energy-supply rod (5).

44. A lifting apparatus according to one of the claims 39 - 43, characterized in that the drums (45) of drum motors (44) are pushed with spring tension against the energy-supply rod (5).

45. A lifting apparatus according to one of the claims 39 - 44, characterized in that the walls of the shuttle booms (3) have a lattice-type design, at least in some sections.

46. A lifting apparatus according to claim 45, characterized in that at least some elements of a shuttle boom (3) consist of glass fiber materials.

47. A lifting apparatus according to one of the claims 45 - 46, characterized in that at least some elements of a shuttle boom (3) are designed in the form of hybrid sandwich-type elements, consisting of layers of glass fiber materials and carbon fiber compound materials.

48. A lifting apparatus according to one of the claims 45 - 47, characterized in that elements of the shuttle boom (3), which are subjected to tensile loads, are made from glass fiber materials and that elements of the shuttle boom (3) that are subjected to pressure loads are made from carbon fiber compound materials.

49. A lifting apparatus according to one of the claims 39 - 48, characterized in that roller blocks (48) are provided on the main frame (2), inside of which the rollers of the roller bearings are positioned displaceable.

50. A lifting apparatus according to claim 49, characterized in that spring leaves (49) that form spring systems are provided on the roller blocks (48), against which the rollers of the roller bearings are pushed in case of a load engagement of shuttle boom (3).

51. A lifting apparatus according to claim 50, characterized in that each spring leaf (49) is positioned between two spring retainers (50).

52. A lifting apparatus according to one of the claims 50 or 51, characterized in that the shuttle booms (3) are provided with crossbeams (4) that are guided inside slide-in compartments (12, 12'), wherein the spring leaves (49) are arranged on the undersides of the slide-in compartments (12, 12').

53. A lifting apparatus according to claim 52, characterized in that flat support elements (52) for guiding the crossbeams (4) of shuttle booms (3) are provided on the inside walls of the slide-in compartments (12, 12').

54. A lifting apparatus according to claim 53, characterized in that the support elements (52) are arranged in pairs on opposite insides of the slide-in compartments (12, 12').

55. A lifting apparatus according to one of the claims 53 or 54, characterized in that the support elements (52) are made from plastic.